U.S. DEPARTMENT OF ENERGY

Hydrogen Delivery

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Merit Review and Peer Evaluation Meeting

May 16, 2006

Hydrogen Delivery

Goal

- Develop hydrogen delivery technologies that enable the introduction and long-term viability of hydrogen as an energy carrier for transportation and stationary power

Scope

- From the end point of central or distributed production (300 psi H2) to and including the dispenser at a refueling station or stationary power site

< $1/gge Overall by 2017

<$.40/gge for Forecourt operations by 2015

Research Areas

Pathways

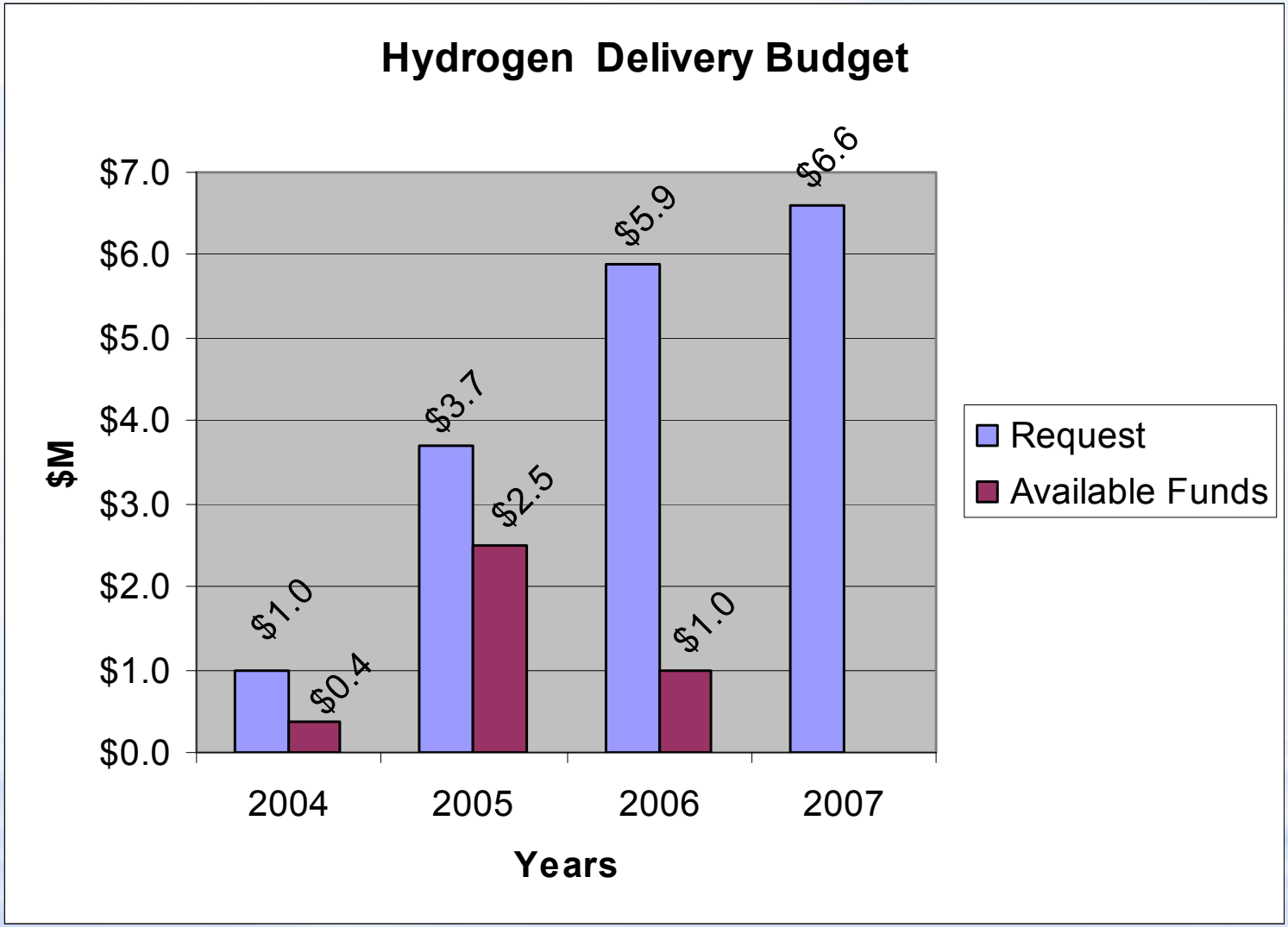
- Gaseous Hydrogen Delivery
- Liquid Hydrogen Delivery
- Carriers

Components

Pipelines
Compression
Liquefaction
Carriers & Transformations
Gaseous Storage Tanks
Geologic Storage
GH2 Tube Trailers

Terminals
Separations/Purification
Dispensers
Liquid Storage Tanks
Mobile Fuelers
Liquid Trucks, Rail, Ships

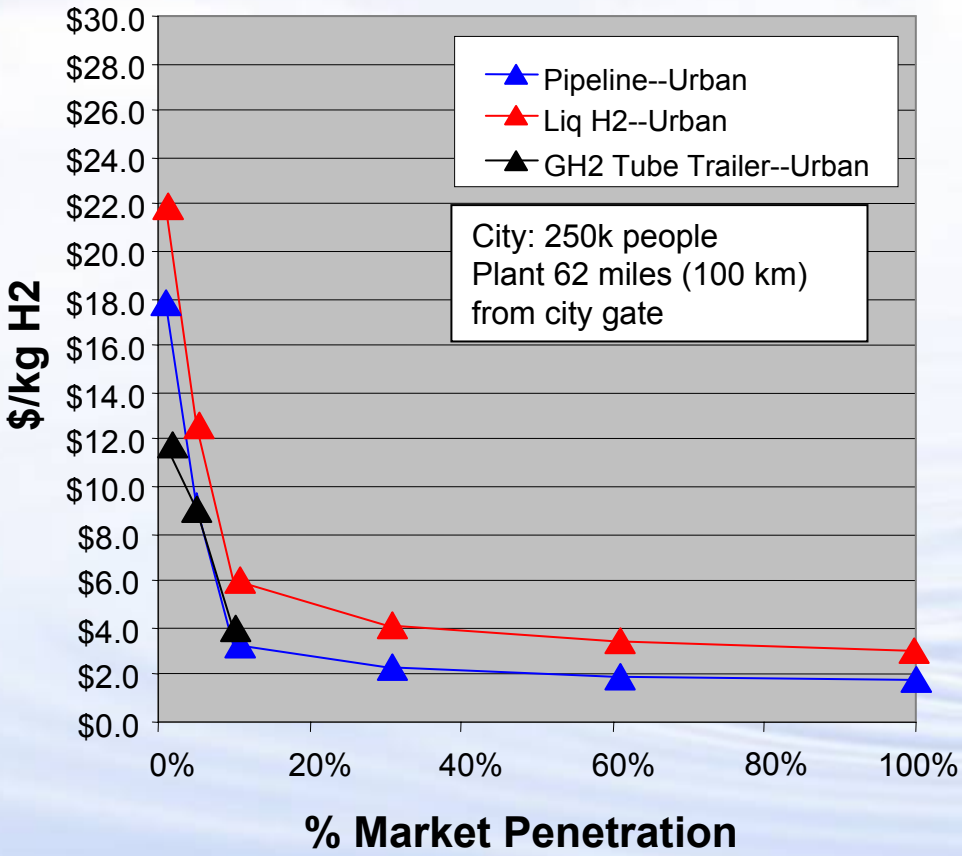
EERE Delivery R&D Budget

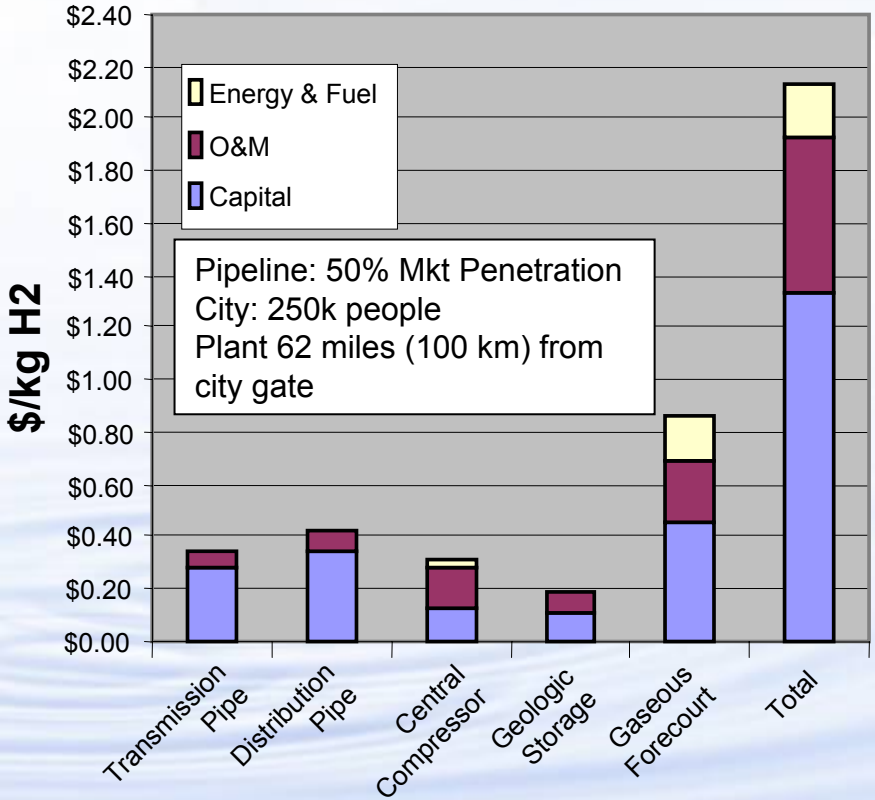


Accomplishments

- **H2A Delivery Models: Components and Scenario Model (www.hydrogen.energy.gov)**

Current Hydrogen Delivery Costs





Accomplishments

- Comprehensive Roadmap: FreedomCAR Delivery Tech Team
- Established a robust portfolio of research projects
- Established a Pipeline Working Group
  - ➔ Fundamental work on hydrogen embrittlement (U. of Illionois)
  - ➔ Strong collaboration across National Labs (ORNL, SRNL, SNL) and industry
  - ➔ Breakthrough composite pipe approach
  - ➔ Mini-Workshops including C&S community
  - ➔ Interaction with EC Naturalhy Project
- Analysis
  - ➔ Nexant: comprehensive collaborative analysis project
  - ➔ GTI: Forecourt options

Key Learnings/Challenges

- **Forecourt costs are significant and need to be reduced**
  - ➔ **Compression reliability needs to be improved**
  - ➔ **Storage: Need a breakthrough in high pressure storage or carrier system**
  - ➔ **O&M costs are high: How can they be reduced**
- **Pipelines are the current low cost pathway for the long term, but:**
  - ➔ **How to move to pipelines (at least transmission) earlier?**
  - ➔ **H2 distribution lines in cities ? And at what pressure?**
- **Transition**
  - ➔ **Low volumes means much higher delivery costs**
  - ➔ **Need a breakthrough: liquefaction, higher H2 content tube trailers, or a carrier approach**

(www.eere.energy.gove/hydrogenandfuelcells/)